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Observations of the Variable Star R Carinae from Sept. 1883, to April 1886. By John Tebbutt.

In the *Monthly Notices*, vol. xlv. p. 14, was published a series of concluded magnitudes of this variable, from comparisons extending from May 11, 1880, to September 3, 1883. I have now much pleasure in presenting to the Society another series, based on comparisons extending from the latter date to the close of April 1886. While the variable was visible to the unassisted eye, it was compared with neighbouring stars of the *Uranometria Argentina*, and while telescopic, with the small stars, whose positions and magnitudes are recorded on p. 17 of the *Monthly Notices* already referred to. The variable could not be seen with the unassisted eye on April 22, 1884, but was pretty distinct on the 15th of the following month. On March 12, 13, December 26, 1885, it was visible without a telescope, on the last-mentioned date distinctly so, but on April 3, 1886, it was remarked as barely visible without telescopic aid, although the sky was beautifully clear and the Moon absent. The $3\frac{1}{4}$ -inch Refractor was employed in almost all the comparisons when the star was telescopic. I have not yet thoroughly discussed the Cordoba and Windsor observations; but it appears, from a cursory examination, that a period of about 312 days will approximately represent the maxima of the star. In conclusion, I shall be obliged by the following corrections of errata in my former paper:—

1882, April 9, for 9.2 read 9.3

„ „ 15, „ 9.3 „ 9.2

Concluded Magnitudes of R Carinæ.

Date.	Mag.	Date.	Mag.	Date.	Mag.
1883, Sept. 30	8.5	1885, Jan. 4	9.1	1885, Sept. 6	9.2
„ Nov. 12	9.1	„ „ 12	9.0	„ Nov. 11	8.1
„ „ 19	9.2	„ „ 16	8.9	„ Dec. 16	6.8
„ Dec. 7	9.2	„ „ 30	8.6	„ „ 26	6.0
„ „ 18	9.1	„ Feb. 4	8.5	1886, Jan. 8	4.9
„ „ 25	9.1	„ „ 8	8.5	„ „ 12	5.1
1884, Jan. 3	9.1	„ „ 26	7.0	„ „ 26	4.6
„ „ 22	9.0	„ Mar. 15	6.4	„ „ 30	4.6
„ Mar. 18	8.5	„ Apr. 2	5.8	„ Feb. 4	4.7
„ „ 31	8.2	„ „ 11	5.7	„ „ 9	4.9
„ Apr. 14	7.2	„ „ 22	6.0	„ „ 11	5.1
„ „ 22	6.8	„ „ 23	6.0	„ „ 21	5.3
„ May 15	6.1	„ May 1	6.3	„ „ 25	5.3
„ „ 30	5.7	„ „ 3	6.4	„ Mar. 4	5.3
„ June 17	6.4	„ „ 16	6.4	„ „ 7	5.3
„ „ 26	6.5	„ June 3	7.3	„ „ 8	5.3
„ July 7	6.9	„ July 1	8.4	„ „ 14	5.6
„ „ 22	7.7	„ „ 25	8.7	„ „ 27	5.9
„ Dec. 12	9.2	„ Aug. 18	9.1	„ Apr. 1	6.3
„ „ 18	9.3	„ „ 31	9.2	„ „ 21	7.3

Windsor, N. S. Wales :

1886, May 1.

Observation of Calliope, made at the Observatory, Düsseldorf.
By R. Luther.

(Extract from a letter to Mr. Stone.)

Mr. Hind's planet (22) *Calliope* has not been observed since 1874 (three times at Paris). I have made the following new observations of it:—

Mean time, Düsseldorf.

(22) *Calliope* (9.6 mag.)

1886, Sept. 18, 10 52	0 R.A. 23 58 16.49.	Decl. — 22 40 41.8	} 6 comp. with Arg. Z. 269, N. 42
parallactical correction — 0.07			

This observation may perhaps be useful to English observers.

Düsseldorf : 1886, September 21.

Observations of Comets, 1877 I., II., III., VI., 1880 III., 1882 III., and 1884 III., made at Dun Echt Observatory, with the 15-in. Refracting Telescope.

(Communicated by the Earl of Crawford and Balcarres.)

Comet 1877 I.

Date. 1877.	Dun Echt Mean Time. h m s	$\Delta\alpha$ m s	$\phi - \star$	$\Delta\delta$ "	α h m s	δ o ' "	Star.	Observer.
Feb. 21	15 12 13.8	+0 52.30		+8 46.7	20 40 50.03	+74 58 2.3	a	R. C.
21	15 48 5.5	+0 13.00		-2 2.1	20 42 39.55	+75 3 17.5	b	R. C.
25	12 54 38.9	+1 41.36		-8 58.3	1 52 25.69	+74 45 36.6	c	R. C.
28	7 56 9.1	+0 2.03		-4 7.8	3 6 9.55	+68 31 13.4	d	R. C.
Mar. 4	9 49 55.1	-0 11.17		+2 48.1	3 45 3.56	+61 35 15.3	e	R. C. 6 meas.
4	10 27 44.9	-0 3.54		+0 42.8	3 45 11.19	+61 33 10.0	e	R. C. 2 meas.
18	10 11 2.8	+0 30.15		+1 19.0	4 23 26.25	+50 31 29.2	f	R. C.
19	11 59 48.3	+0 2.98		+1 43.2	4 25 0.29	+50 3 58.7	g	R. C.

Comet 1877 II.

April 18	15 40 40	+0 2.58		+2 20.5	22 22 5.79	+33 24 34.6	h	J. G. L. and R. C.
19	15 3 49	-0 26.53		+2 20.9	22 23 45.34	+35 8 1.8	i	R. C. 5 meas.
19	15 47 47	-0 23.32		+5 38.3	22 23 48.55	+35 11 19.2	i	J. G. L. 3 meas.
25	12 56 32	-0 14.09		+6 39.2	22 37 31.37	+46 37 57.6	k	J. G. L.
25	13 19 55	-0 10.96		+8 42.6	22 37 34.50	+46 40 1.0	k	R. C.
26	11 57 3	+1 7.23		-0 22.8	22 40 35.38	+48 38 47.2	l	R. C.

Date. 1877.	Dan Licht Mean Time. h m s	Δa m s	$\Delta \delta$ ' "	α h m s			δ ° ' "	Star.	Observer.
Comet 1877 III.									
April 18	12 2 24	-0 4'53	+5 30'5	1 42 28'36			+57 56 56'3	m	R. C.
18	12 39 54	+0 11'16	+6 16'9	1 42 44'05			+57 57 42'7	m	J. G. L.
19	13 36 59	+0 27'47	-4 17'7	1 53 8'53			+58 36 14'4	n	R. C.
19	13 57 20	+0 36'71	-3 43'0	1 53 17'77			+58 36 49'2	n	J. G. L.
29	12 24 48	+0 45'98	+4 20'2	3 55 57'09			+61 31 46'9	o	J. G. L.
Comet 1877 VI.									
Nov. 13	14 26 4	+0 5'87	-0 19'4	6 0 39'84			+15 36 38'3	p	R. C. and J. G. L.
27	11 52 43	-0 2'43	-3 38'7	4 52 20'64			- 0 6 53'4	q	R. C.
Comet 1880 III.									
1880. Oct. 6	8 18 56	-3 7'57	... ..	16 6 58'48			... ..	r	R. C.
6	8 41 14	... ..	-9 58'5	... ..			+24 39 51'0	r	R. C.
19	7 47 18	-1 15'85	... ..	17 40 29'93			... ..	s	J. G. L.
19	7 47 50	... ..	+0 27'0	... ..			+15 5 36'8	s	J. G. L.
19	7 47 56	-1 43'43	... ..	17 40 30'17			... ..	t	J. G. L.
19	7 49 13	... ..	+0 38'2	... ..			+15 5 30'8	t	J. G. L.
25	7 19 5	+0 31'58	+7 26'2	18 1 26'18			+12 27 45'7	u	J. G. L.
Comet 1882 III. (Barnard).									
1882. Sept. 16	15 32 30	+0 18'32	+0 16'5	7 22 54'07			+14 36 4'5	v	J. G. L.
17	14 44 34	+2 4'58	+1 39'0	7 24 49'50			+13 47 54'5	w	J. G. L.

Comet 1884 III.

Date. 1884.	Dun Echt Mean Time.	$\Delta \alpha$ m s	$\Delta \delta$ ' "	α h m s	δ ° ' "	Star.	Observer.
Sept. 22	14 5 46	+0 12.51	-1 40.9	21 16 21.29	+21 26 18.6	<i>x</i>	R. C.
22	15 13 54	+1 21.75	-7 40.3	21 16 22.77	+21 25 0.1	<i>y</i>	R. C.
24	12 28 27	-1 10.08	+4 18.0	21 17 25.73	+20 33 58.5	<i>z</i>	R. C.
27	11 26 38	+2 37.13	-7 30.0	21 19 23.75	+19 11 31.4	<i>a</i>	R. C.

Observers, Ralph Copeland and J. G. Lohse.

Adopted Mean Places of Comparison Stars.

Star.	α , 1877 ^o . h m s	Red. s	δ , 1877 ^o . ° ' "	Red. "	Authority.
<i>a</i>	20 40 3.87	-6.14	+74 49 27.6	-12.0	2 Dun Echt Merid. Obs.
<i>b</i>	20 42 32.84	-6.29	+75 5 31.3	-11.7	" "
<i>c</i>	1 50 47.79	-3.46	+74 54 13.2	+21.7	Mean of A.-Ö. 2180, 5 Rad. and Bonn Obs., Vol. VI.
<i>d</i>	3 6 8.30	-0.78	+68 34 57.1	+24.1	Bonn Obs., Vol. VI.
<i>e</i>	3 45 14.59	+0.14	+61 32 4.2	+23.0	4 Dun Echt Merid. Obs.
<i>f</i>	4 22 55.66	+0.44	+50 29 50.9	+19.2	3 " "
<i>g</i>	4 24 56.87	+0.44	+50 1 56.5	+19.0	2 " "
<i>h</i>	22 22 4.09		+33 22 30.4		Lalande 43881, not used.
<i>h</i>	22 22 3.34	-0.13	+33 22 25.1	-11.0	2 resp. 3 Dun Echt Obs.
<i>i</i>	22 24 12.03	-0.16	+35 5 52.0	-11.1	Bessel-Weisse, 22 ^b , 512.
<i>k</i>	22 37 46.16		+46 31 28.1		A.-Ö. 24559, '60, not used.
<i>k</i>	22 37 45.92	-0.46	+46 31 30.1	-11.7	5 Dun Echt Obs. '77-'79.
<i>l</i>	22 39 28.69	-0.54	+48 39 21.9	-11.9	5 " "

Star.	α , 1877 ^o . h m s	Red. s	δ , 1877 ^o . $^{\circ}$ $'$ $''$	Red. "	Authority.
<i>m</i>	1 42 34 ^h 89 ^s		+57 51 19 ^o		A.-Ö. 2031, not used.
<i>n</i>	1 42 34 ^h 52 ^s	-1 ^h 63 ^s	+57 51 20 ^h 1 ^s	+ 5 ^h 7 ^s	Helsingfors Zones 258 and 261.
<i>n</i>	1 52 42 ^h 70 ^s	-1 ^h 64 ^s	+58 40 25 ^h 6 ^s	+ 6 ^h 5 ^s	2 Dun Echt Obs.
<i>o</i>	3 55 12 ^h 09 ^s		+61 27 9 ^h 5 ^s		A.-Ö. 4396, not used.
<i>o</i>	3 55 12 ^h 03 ^s	-0 ^h 92 ^s	+61 27 13 ^h 0 ^s	+13 ^h 7 ^s	Helsingfors Zones 299, 547 and 588.
<i>p</i>	6 0 29 ^h 32 ^s	+4 ^h 65 ^s	+15 36 48 ^h 4 ^s	+ 9 ^h 3 ^s	Bessel-W ₂ V, 1976.*
<i>q</i>	4 52 18 ^h 43 ^s	+4 ^h 64 ^s	- 0 3 31 ^h 3 ^s	+16 ^h 6 ^s	Gött. Cat. 1401-2.
<i>r</i>	α 1880 ^o . 16 10 4 ^h 21 ^s	+1 ^h 84 ^s	δ 1880 ^o . +24 49 47 ^h 4 ^s	+ 2 ^h 1 ^s	B.-W ₂ XVI. 274.
<i>s</i>	17 41 43 ^h 46 ^s	+2 ^h 32 ^s	+15 5 0 ^h 9 ^s	+ 8 ^h 9 ^s	B.-W ₂ XVII. 1309.
<i>t</i>	17 42 11 ^h 28 ^s	+2 ^h 32 ^s	+15 4 43 ^h 7 ^s	+ 8 ^h 9 ^s	B.-W ₂ XVII. 1327.
<i>u</i>	18 0 52 ^h 19 ^s	+2 ^h 41 ^s	+12 20 9 ^h 7 ^s	+ 9 ^h 8 ^s	B.-W ₂ XVII. 1266.
<i>v</i>	α 1882 ^o . 7 22 32 ^h 99 ^s	+2 ^h 76 ^s	δ 1882 ^o . +14 35 56 ^h 0 ^s	- 8 ^h 0 ^s	2 Leipzig Merid. Obs. A. N. 2457.
<i>w</i>	7 22 42 ^h 15 ^s	+2 ^h 77 ^s	+13 46 23 ^h 3 ^s	- 7 ^h 8 ^s	B.-W. VII. 636.
<i>x</i>	α 1884 ^o . 21 16 5 ^h 38 ^s	+3 ^h 40 ^s	δ 1884 ^o . +21 27 29 ^h 5 ^s	+30 ^h 0 ^s	2 Dun Echt Obs. 1886.
<i>y</i>	21 14 57 ^h 63 ^s	+3 ^h 39 ^s	+21 32 10 ^h 4 ^s	+30 ^h 0 ^s	B.-W ₂ XXI. 319.
<i>z</i>	21 18 32 ^h 42 ^s	+3 ^h 39 ^s	+20 29 10 ^h 4 ^s	+30 ^h 1 ^s	Bonn Obs. VI., +20°, 4902.
<i>a</i>	21 16 43 ^h 28 ^s	+3 ^h 34 ^s	+19 18 31 ^h 2 ^s	+30 ^h 2 ^s	1 Pegasi, Berl. J. B.

The star e = D.M. + 61°, 648, is decidedly red in colour; 1877, March 4.

The star o = D.M. + 61°, 667, is of a very deep orange colour; 1877, April 29.

* The star D.M. + 15°, 1076, 9^m.5 does not exist as a single star, although there are several small stars about the place given in the D.M.

Remarks and Descriptions.

COMET 1877 I.

The observations on February 21 were made with a ring micrometer; all the others are derived from measures of position and distance with the filar micrometer. Refraction has been fully taken into account.

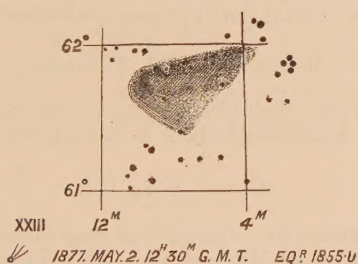
March 4.—The second observation was made to test the effect of the approach to a star on the measures. But eventually, as the central distance became very small, it was impossible to distinguish the relative position of the star and the densest part of the comet. About $10^h 39^m.0$ ($9^h 30^m$ by chronometer) the comet seemed to pass centrally over the star. As usual in similar cases, this estimate differs considerably from the measures, which indicate a central distance of $10''.6$ at that time.

March 19.—Comet very faint; round; $8''.5$ in diameter.

COMET 1877 II.

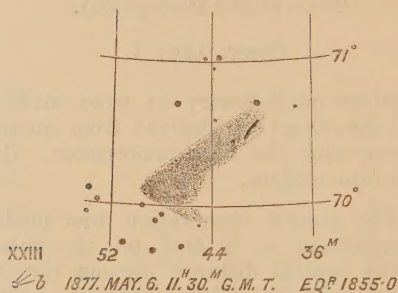
April 11.—The comet has a narrow tail about $18'$ long. The nucleus about as bright as a $6\frac{1}{2}$ mag. star.

April 13.—Tail about $31'$ long, in position 260° .



May 2.—Sketched at $12^h 30^m$, G.M.T. The chief tail was $1\frac{1}{2}$ field, or $56'$ in length. The lateral tail was in position angle about 75° less than the main tail, but the interval was almost completely filled in with nebulosity. The outer edge of the chief tail is very well defined. Examined with power 430 the nucleus is fairly defined as a very small nebula in the midst of the coma, very suddenly exceedingly much brighter in the middle. Aurora and twilight very bright, or doubtless the tail could have been traced farther.

May 6.—Comet sketched at 11^h 30^m, G.M.T.



For spectroscopic observations of comets 1877 II. and III., see *Monthly Notices*, vol. xxxvii. p. 430.

COMET 1877 III.

April 18.—Comet round; much brighter in the middle; 1½' in diameter.

April 29.—Comet round; gradually brighter in the middle; 57'' in diameter.

COMET 1880 III.

1880, October 25.—Tail well visible, as broad as the coma; 15' long in position 62° 6', by two measures. There is no real nucleus, but the central part appears granulated.

COMET 1882 III. (Barnard).

1882, Sept. 16. The comet is fairly bright, gradually much brighter in the middle and about 2' in diameter with power 229.

COMET 1884 III.

1884, September 22.—This comet was found at Dun Echt by its spectrum, at 0^h 3^m, sidereal time, with the object-glass prism, on the 6-inch Simms Equatorial. The next morning a telegram was received announcing that it had already been discovered by Herr Wolf, at Heidelberg, on September 17. (See *Ast. Nach.*, Bd. 110, col. 9.) In Dun Echt circular 91, the time is wrong.

September 24.—Comet about 3' diam.; elongated towards the *n p* side; nucleus not in the middle.

September 27.—With power 229; diameter in parallel 6^s to 7^s; greatest condensation *n p* the centre.

Sup. 1886.

Sydney Observations of Comets.

495

(Communicated by H. C. Russell, B.A., Government Astronomer.)

Observations of Comet d, 1885 (Fabry).

Date.	Sydney M.T.	Star's Name.	Comparison Star's		Comet's diff. from Star.		Comet's		Comet's Ap- parent N.P.D.	No. of Comp.	Observer.
1886.	h m s		R.A.	N.P.D.	R.A.	N.P.D.	h m s	h m s			
May 2	6 48 59	151 Washington 1875	4 22 38.02	88 52 35.3	+0 48.65	0 0'0"	4 23 26.67	88 52 35.3	11	H.C.R.	
6	8 4 29	Lalande 11334	5 52 32.38	108 4 11.7	-1 29.69	+3 40.8	5 51 2.69	108 7 52.5	8	H.C.R.	
10	9 7 26	3272 Cape Cat. 1880	6 49 1.25	118 23 28.0	-0 22.20	-5 36.1	6 48 39.05	118 17 52.0	5	H.C.R.	
12	7 48 15	3494	7 9 23.63	120 53 41.8	-1 13.45	+6 13.7	7 8 10.18	120 59 55.5	4	H.C.R.	
13	7 27 8		7 16 34.34	122 5 22.8	0 0'00	0 0'0"	7 16 34.34	122 5 22.8		J.A.P.	
14	7 50 44	3715	7 29 6.89	123 9 37.4	-4 43.18	-2 24.8	7 24 23.71	123 7 12.6	8	H.C.R.	
19	7 49 28	3970	7 48 51.78	126 4 29.4	+4 44.75	+8 9.9	7 53 36.53	126 12 39.4	10	H.C.R.	
20	8 50 6	4076	7 57 54.59	126 44 22.1	+0 12.73	-5 56.9	7 58 7.32	126 38 25.2	10	H.C.R.	
21	7 58 36	4071	7 57 27.11	126 58 26.8	+4 52.58	+3 17.1	8 2 19.69	127 1 43.9	10	H.C.R.	
22	7 17 40	4147	8 4 26.96	127 21 18.8	+1 40.52	+0 47.2	8 6 7.48	127 22 5.9	10	H.C.R.	
23	7 59 16	4207	8 8 40.64	127 35 17.1	+1 12.82	+6 29.5	8 9 53.46	127 41 46.6	10	J.A.P.	
26	9 19 13	4458	8 29 24.62	128 27 57.1	-9 38.90	+2 55.9	8 19 45.72	128 30 53.0	3	H.C.R.	
26	9 19 13	4354	8 22 6.67	128 41 31.9	-2 20.25	-10 39.9	8 19 46.42	128 30 52.0	3	H.C.R.	
30	8 28 28	4482	8 31 0.81	129 35 7.4	-0 29.86	-14 13.8	8 30 30.95	129 20 53.6	10	H.C.R.	
30	8 28 28	4482	8 31 0.81	129 35 7.4	-0 30.00	-14 12.5	8 30 30.81	129 20 54.9	7	J.A.P.	
31	7 54 46	4482	8 31 0.80	129 35 7.2	+1 52.75	-3 23.2	8 32 53.55	129 31 44.0	8	H.C.R.	
31	7 54 46	4482	8 31 0.80	129 35 7.2	+1 52.27	-3 21.7	8 32 53.07	129 31 45.5	6	J.A.P.	
June 1	8 20 46	4512	8 33 12.36	129 45 26.3	+2 4.45	-3 6.8	8 35 16.81	129 42 19.5	5	H.C.R.	
1	8 20 46	4539	8 36 8.16	129 51 58.9	-0 51.71	-9 39.1	8 35 16.45	129 42 19.9	6	J.A.P.	
2	8 23 18	4539	8 36 8.13	129 51 58.8	+1 24.69	+0 29.5	8 37 32.82	129 52 28.3	10	J.A.P.	

Date.	Sydney M.T.	Star's Name.	Comparison Star's R.A.			Comet's diff. from Star. R.A.			Comet's Apparent R.A.			Comet's Ap- parent N.P.D.	No. of Comp.	Observer.
			h	m	s	h	m	s	h	m	s	"		
-1886.														
June 7	8 57 20	4707	8 47	42	30	130	33	52.0	+ 0	9	85	+ 4	8 5	50
11	7 3 34	4803	8 57	6	78	131	25	24.5	- 2	1	04	- 14	299	10
13	9 4 4	4803	8 57	6	74	131	25	24.2	+ 1	35	55	+ 0	57.8	4
20	7 43 39	4926	9 10	9	32	131	45	42.2	- 0	13	74	+ 34	40.6	5
25	7 57 7	5002	9 17	28	01	131	42	47.4	+ 0	2	94	+ 75	47.4	5
27	8 33 44	5040	9 20	50	18	133	29	32.1	- 0	19	34	- 14	287	5
29	8 30 40	5040	9 20	50	15	133	29	31.7	+ 2	35	73	+ 1	10.5	4

May 2.—At 6^h 48^m 59^s S.M.T. the comet was on the same declination wire as the star.

6.—At 8^h 20^m 0^s.31 comet passed over a 10 mag. star.

13.—Comet passed over a 9th mag. star at 7^h 27^m 8^s S.M.T.; the position of this star has been obtained by finding the difference by the micrometer between it and 3619 Cape Cat. (1880). The star is the larger member of a double, No. 3954 Herschel's Cape list.

14.—Nucleus about as bright as a 9th mag. star. May 20.—Nucleus small and well defined yet.

22.—Night fine and definition steady; nucleus still visible, though faint.

26.—Hazy night; observations difficult.

June 7.—Comet extremely faint but in a good position for observation with Cape Cat. (1880) 4707.

11.—A very faint nucleus still visible.

20.—*No star near comet within range of micrometer. Position got by circles. 4926 Cape Cat. (1880); observed for index errors.

25.—*No star near. Position got by circles. 5002 Cape Cat. (1880); observed for index errors.

27.—*No star near. Position got by circles. 5040 Cape Cat. (1880); observed for index errors.

July 3.—Comet looked for but not seen. A small star at 9^h 29^m 9^s R.A., 134° 3' 3" N.P.D., looked hazy, and was thought to be in comet's haze.

* Probable error of a position determined by means of the circles is 0".5 in R.A. and 7" in Decl.

Comet e, 1885 (Barnard).

Date.	Sydney M.T.	Star's Name.	Comparison Star's R.A.	N.P.D.	Comet's diff. from Star. R.A.	N.P.D.	Comet's Apparent R.A.	Comet's Ap- parent N.P.D.	No. of Comp.	Observer.
1886.	h m s		h m s	° ' "	m s	' "	h m s	° ' "		
June 5	7 59 54	2700 Cape Cat. 1880	5 51 33.46	127 8 29.4	+ 4 36.06	- 4 12.2	5 56 9.52	127 4 17.3	5	J.A.P.
20	7 6 21	4081	7 58 23.69	140 17 37.6	- 1 44.54	+ 4 52.8	7 56 39.15	140 22 30.4	5	H.C.R.
25	7 20 55	4332	8 19 42.95	141 45 46.3	+ 1 33.60	- 2 16.8	8 21 16.55	141 43 29.5	5	H.C.R.
29	7 51 43	4555	8 37 0.90	142 31 23.1	+ 0 45.96	- 1 1.5	8 37 46.86	142 30 21.5	12	H.C.R.
July 1	7 17 47	4625	8 41 30.89	142 40 11.6	+ 3 34.90	+ 10 3.0	8 45 5.79	142 50 14.7	1	J.A.P.
3	8 16 32	4825	8 59 38.45	143 6 17.4	- 7 28.06	+ 2 17.2	8 52 10.39	143 8 34.5	3	H.C.R.

Comet c, 1886.

Date.	Sydney M.T.	Star's Name.	Comparison Star's R.A.	N.P.D.	Comet's diff. from Star. R.A.	N.P.D.	Comet's Apparent R.A.	Comet's Ap- parent N.P.D.	No. of Comp.	Observer.
1886.	h m s		h m s	° ' "	m s	' "	h m s	° ' "		
June 27	7 46 12	Weisse (12) 1039	13 2 7.42	102 30 37.9	- 1 20.61	+ 3 23.6	13 0 46.08	102 34 1.6	8	H.C.R.
July 3	9 10 20	Weisse (12) 1039	13 2 7.36	102 30 37.6	+ 14 41.00	+ 270 43.0	13 16 48.00	106 1 20.0	1	H.C.R.

Comet Brooks I, 1886.

Date.	Sydney M.T.	Star's Name.	Comparison Star's R.A.	N.P.D.	Comet's diff. from Star. R.A.	N.P.D.	Comet's Apparent R.A.	Comet's Ap- parent N.P.D.	No. of Comp.	Observer.
1886.	h m s		h m s	° ' "	m s	' "	h m s	° ' "		
July 3	7 5 11	4688 Cape Cat. 1880	8 45 58.22	6 45 16.0	- 37 33.00	+ 153 4.0	8 8 25.00	8 18 20.0	3	J.A.P.

The initials H.C.R. refer to H. C. Russell, and J.A.P. to J. A. Pollock.

June 3.—Barnard seen, but too cloudy for observations.

20.—Barnard in a coarse cluster about equal to a 9th mag. star; diameter of coma about 7".

26.—Comet c seen.

July 3.—*Comet Brooks I. very close to horizon; position obtained by circles. Comet c 1886 very faint; position got by circles.

* Probable error of a position determined by means of the circles is 0.5 in R.A. and 7" in Decl.

A transit of Comet Fabry over a 10 mag. star occurred on May 6, 1886. No change in the brightness of the star could be seen as it approached the nucleus or receded from it; and it could be seen distinctly in the edge, but not in the centre. There, although it could be seen that the centre was brighter, owing to the added light of the star, it was not possible to separate one from the other, even with the large telescope, so fairly central was the transit. In fact, the starlight could be seen all the time, but the two points of light could not be separated. The transit occurred at 8^h 20^m 0^s.31 S.M.T.

A transit of Comet Fabry over the larger member (9 mag.) of a double star, No. 3954, Herschel's Cape list, was observed on May 13, 1886.

As the comet neared the star nothing could be seen of it except the nucleus, which appeared fainter than the star, but not as faint as the small companion of 11 mag. about 8'' off. The transit took place at 7^h 27^m 8^s S.M.T. The comet was lost sight of during transit, although the faint companion could be well seen, and the brightness of the star remained unchanged.

Comet Fabry was first seen in this colony on Saturday, May 1, by persons in many parts of the colony, but light clouds obscured the sky in Sydney. On May 2 I saw it at 6.15 P.M., when the daylight was still strong; it was a conspicuous object, with a tail 4° long. With the telescope the nucleus was well defined, and the coma free from remarkable features. The 11½-inch Equatorial and filar micrometer were used for all observations. The comet was observed by me to pass over a 10th mag. star on May 6th, and over a 9th mag. star on May 13, by Mr. Pollock who was assisting me.

Sydney Observatory:
1886, July 12.

Sextant Observations of Fabry's Comet.

(Communicated by Captain H. Toynbee.)

Observations made on board the ship "St. Patrick," by Captain James Campbell.

1886, May 2; Lat. 31° 55' S.; Long. 32° 11' E.; 6^h 45^m P.M., A.T.S.

Distance of Comet from	<i>Sirius</i>	...	...	35 41
"	"	"	<i>Betelgeuse</i> ...	20 57
"	"	"	<i>Castor</i>	52 50

1886, May 3; Lat. 32° 21' S.; Long. 31° 3' E.; 6^h 30^m P.M., A.T.S.

Distance of Comet from	<i>Sirius</i>	...	...	20 54
"	"	"	<i>Castor</i>	53 14

Observations made on board the barque "Cassandra," by
Captain D. S. Cromarty.

1886, May 2, 9^h 25^m, G.M.T.; Lat. 6° 16' S.; Long. 29° 44'
W. Comet's position as follows:—

Nucleus to <i>Rigel</i>	...	...	...	...	10° 45'
„ <i>Capella</i>	...	...	...	...	35 04
„ <i>Canopus</i>	...	...	...	...	54 52

Ephemerides of the Satellites of Saturn, 1886–87. By A. Marth.

(Continued from p. 486.)

*Differences of Right Ascension and Declination between the three outer
Satellites and the centre of Saturn.*

Greenwich Noon. 1886.	<i>Titan.</i>		<i>Hyperion.</i>		<i>Iapetus.</i>	
	$\alpha_s - A.$	$\delta - D.$	$\alpha_s - A.$	$\delta - D.$	$\alpha_s - A.$	$\delta - D.$
Nov. 20	+ 8° 02'	– 53° 0'	+ 6° 99'	– 86° 4'	+ 0° 43'	+ 90° 2'
21	+ 11° 87'	– 26° 2'	+ 10° 95'	– 68° 8'	– 2° 93'	+ 84° 5'
22	+ 13° 93'	+ 4° 7'	+ 14° 23'	– 46° 8'	6° 28'	78° 2'
23	+ 13° 81'	+ 35° 0'	+ 16° 57'	– 21° 6'	– 9° 59'	+ 71° 4'
24	+ 11° 48'	+ 59° 7'	+ 17° 75'	+ 5° 2'	12° 86'	64° 0'
25	+ 7° 24'	+ 74° 6'	+ 17° 57'	+ 31° 7'	– 16° 05'	+ 56° 2'
26	+ 1° 77'	+ 77° 1'	+ 15° 92'	+ 55° 6'	19° 14'	47° 9'
27	– 4° 01'	+ 66° 6'	+ 12° 77'	+ 74° 3'	– 22° 10'	+ 39° 3'
28	– 9° 15'	+ 45° 1'	+ 8° 29'	+ 85° 4'	24° 93'	30° 4'
29	– 12° 83'	+ 16° 2'	+ 2° 85'	+ 86° 7'	– 27° 59'	+ 21° 1'
30	– 14° 52'	– 15° 3'	– 2° 94'	+ 77° 5'	30° 06'	11° 7'
Dec. 1	– 14° 02'	– 44° 7'	– 8° 38'	+ 58° 4'	– 32° 34'	+ 2° 1'
2	– 11° 45'	– 67° 7'	– 12° 78'	+ 31° 9'	34° 39'	– 7° 5'
3	– 7° 23'	– 81° 1'	– 15° 69'	+ 1° 5'	– 36° 21'	– 17° 2'
4	– 1° 97'	– 83° 0'	– 16° 90'	– 29° 2'	37° 78'	26° 8'
5	+ 3° 58'	– 73° 1'	– 16° 43'	– 57° 3'	– 39° 09'	– 36° 2'
6	+ 8° 63'	– 52° 7'	– 14° 51'	– 80° 4'	40° 13'	45° 5'
7	+ 12° 42'	– 24° 5'	– 11° 41'	– 97° 1'	– 40° 89'	– 54° 5'
8	+ 14° 34'	+ 7° 5'	– 7° 47'	– 106° 9'	41° 37'	63° 2'
9	+ 14° 01'	+ 38° 4'	– 3° 00'	– 109° 3'	– 41° 56'	– 71° 5'
10	+ 11° 41'	+ 63° 2'	+ 1° 68'	– 104° 7'	41° 46'	79° 4'
11	+ 6° 92'	+ 77° 6'	+ 6° 27'	– 93° 4'	– 41° 07'	– 86° 8'
12	+ 1° 25'	+ 79° 0'	+ 10° 47'	– 76° 3'	40° 39'	93° 6'
13	– 4° 64'	+ 67° 1'	+ 14° 02'	– 54° 3'	– 39° 43'	– 99° 8'

Greenwich Noon. 1886.		$\alpha_s - A.$	$\delta - D.$	$\alpha_7 - A.$	$\delta_7 - D.$	$\alpha_s - A.$	$\delta_s - D.$
Dec.	14	— 9'77	+ 44''1	+ 16'64	— 28''6	38'20	105''4
	15	— 13'35	+ 13'9	+ 18'12	— 0'9	— 36'71	— 110'3
	16	— 14'85	— 18'6	+ 18'22	+ 27'0	34'96	114'5
	17	— 14'10	— 48'5	+ 16'82	+ 52'7	— 32'97	— 117'9
	18	— 14'28	— 71'4	+ 13'88	+ 73'6	30'75	120'5
	19	— 6'83	— 84'1	+ 9'52	+ 87'0	— 28'33	— 122'4
	20	— 1'41	— 84'8	+ 4'09	+ 90'7	25'71	123'4
	21	+ 4'23	— 73'6	— 1'84	+ 83'4	— 22'91	— 123'7
	22	+ 9'27	— 51'7	— 7'54	+ 65'5	19'96	123'1
	23	+ 12'94	— 22'1	— 12'30	+ 39'4	— 16'87	— 121'7
	24	+ 14'65	+ 10'8	— 15'60	+ 8'4	13'67	119'6
	25	+ 14'05	+ 42'2	— 17'15	— 23'8	— 10'37	— 116'6
	26	+ 11'18	+ 66'7	— 16'98	— 53'6	7'00	112'9
	27	+ 6'38	+ 80'3	— 15'26	— 78'7	— 3'58	— 108'4
	28	+ 0'63	+ 80'4	— 12'28	— 97'5	— 0'14	103'2
	29	— 5'31	+ 67'0	— 8'37	— 109'0	+ 3'31	— 97'3
	30	— 10'38	+ 42'4	— 3'86	— 113'1	6'75	90'8
	31	— 13'78	+ 11'0	+ 0'89	— 109'7	+ 10'15	— 83'7
1887. Jan.	1	— 15'03	— 22'3	+ 5'60	— 99'3	13'48	76'0
	2	— 14'02	— 52'4	+ 9'96	— 82'7	+ 16'74	— 67'8
	3	— 10'94	— 74'8	+ 13'69	— 60'8	19'89	59'1
	4	— 6'29	— 86'5	+ 16'53	— 34'9	+ 22'92	— 50'0
	5	— 0'74	— 86'0	+ 18'23	— 6'6	25'82	40'5
	6	+ 4'91	— 73'3	+ 18'57	+ 22'2	+ 28'56	— 30'8
	7	+ 9'86	— 49'9	+ 17'41	+ 49'2	31'12	20'8
	8	+ 13'34	— 19'2	+ 14'69	+ 71'9	+ 33'50	— 10'7
	9	+ 14'80	+ 14'4	+ 10'51	+ 87'4	35'68	— 0'4
	10	+ 13'93	+ 45'8	+ 5'17	+ 93'3	+ 37'64	+ 9'9
	11	+ 10'79	+ 69'8	— 0'77	+ 87'9	39'37	20'2
	12	+ 5'86	+ 82'3	— 6'62	+ 71'6	+ 40'87	+ 30'5
	13	— 0'06	+ 80'9	— 11'63	+ 46'1	42'12	40'6
	14	— 5'96	+ 65'9	— 15'22	+ 15'0	+ 43'11	+ 50'5
	15	— 10'88	+ 40'0	— 17'09	— 17'9	43'84	60'1
	16	— 14'06	+ 7'7	— 17'18	— 49'1	+ 44'30	+ 69'4
	17	— 15'04	— 26'0	— 15'68	— 75'8	44'50	78'3
	18	— 13'76	— 55'8	— 12'86	— 96'2	+ 44'43	+ 86'8
	19	— 10'46	— 77'4	— 9'06	— 109'3	44'08	94'8
	20	— 5'66	— 88'0	— 4'62	— 114'8	+ 43'47	+ 102'2

Greenwich Noon. 1887.		$\alpha_6 - A.$ s	$\delta_6 - D.$	$\alpha_7 - A.$ s	$\delta_7 - D.$	$\alpha_8 - A.$ s	$\delta_8 - D.$
Jan.	21	- 0'06	- 86''1	+ 0'13	- 112''7	42'59	109'0
	22	+ 5'54	- 72'0	+ 4'87	- 103'3	+ 41'45	+ 115'2
	23	+ 10'34	- 47'5	+ 9'30	- 87'5	40'05	120'7
	24	+ 13'60	- 16'0	+ 13'14	- 66'2	+ 38'41	+ 125'4
	25	+ 14'78	+ 17'9	+ 16'12	- 40'6	36'53	129'4
	26	+ 13'63	+ 49'0	+ 18'00	- 12'3	+ 34'42	+ 132'6
	27	+ 10'28	+ 72'1	+ 18'57	+ 16'9	32'10	134'9
	28	+ 5'21	+ 83'2	+ 17'66	+ 44'7	+ 29'58	+ 136'4
	29	- 0'72	+ 80'4	+ 15'21	+ 68'6	26'88	137'0
	30	- 6'52	+ 64'1	+ 11'29	+ 85'7	+ 24'01	+ 136'7
	31	- 11'25	+ 37'2	+ 6'16	+ 93'6	20'99	135'6
Feb.	1	- 14'16	+ 4'3	+ 0'32	+ 90'5	+ 17'84	+ 133'6
	2	- 14'87	- 29'2	- 5'54	+ 76'1	14'58	130'7
	3	- 13'35	- 58'4	- 10'69	+ 52'1	+ 11'23	+ 126'9
	4	- 9'88	- 79'1	- 14'52	+ 21'6	7'82	122'3
	5	- 5'00	- 88'4	- 16'67	- 11'3	+ 4'36	+ 116'8
	6	+ 0'58	- 85'2	- 17'06	- 43'1	+ 0'88	110'6
	7	+ 6'06	- 69'9	- 15'83	- 70'9	- 2'60	+ 103'6
	8	+ 10'66	- 44'6	- 13'25	- 92'6	6'06	95'9
	9	+ 13'67	- 12'7	- 9'64	- 107'1	- 9'46	+ 87'5
	10	+ 14'59	+ 21'0	- 5'35	- 114'0	12'79	78'6
	11	+ 13'21	+ 51'4	- 0'71	- 113'3	- 16'03	+ 69'1
	12	+ 9'69	+ 73'3	+ 3'97	- 105'3	19'14	59'1
	13	+ 4'57	+ 83'1	+ 8'39	- 90'8	- 22'12	+ 48'7
	14	- 1'30	+ 78'9	+ 12'27	- 70'6	24'93	37'9
	15	- 6'94	+ 61'6	+ 15'35	- 46'0	- 27'57	+ 26'9
	16	- 11'43	+ 34'1	+ 17'40	- 18'3	30'00	15'7
	17	- 14'09	+ 1'2	+ 18'20	+ 10'6	- 32'22	+ 4'4
	18	- 14'56	- 31'8	+ 17'59	+ 38'6	34'21	- 6'9
	19	- 12'85	- 60'0	+ 15'49	+ 63'2	- 35'95	- 18'1
	20	- 9'28	- 79'5	+ 11'92	+ 81'8	37'43	29'3
	21	- 4'39	- 87'6	+ 7'11	+ 91'6	- 38'65	- 40'2
	22	+ 1'11	- 83'4	+ 1'52	+ 90'9	39'60	50'8
	23	+ 6'43	- 67'3	- 4'26	+ 79'0	- 40'27	- 61'1
	24	+ 10'80	- 41'6	- 9'47	+ 57'2	40'66	70'9
	25	+ 13'57	- 9'8	- 13'50	+ 28'3	- 40'76	- 80'3
	26	+ 14'26	+ 23'3	- 15'94	- 3'9	40'58	89'0
	27	+ 12'71	+ 52'7	- 16'66	- 35'6	- 40'12	- 97'1
	28	+ 9'10	+ 73'4	- 15'78	- 63'8	39'39	104'6

Greenwich Noon. 1887.		$\alpha_6 - A.$	$\delta_6 - D.$	$\alpha_7 - A.$	$\delta_7 - D.$	$\alpha_8 - A.$	$\delta_8 - D.$
		^s	^s	^s	^s	^s	^s
Mar.	1	+ 4'00	+ 81'9	- 13'52	- 86'5	- 38'40	- 111'3
	2	- 1'75	+ 76'7	- 10'21	- 102'4	37'15	117'2
	3	- 7'20	+ 58'7	- 6'17	- 110'8	- 35'65	- 122'4
	4	- 11'45	+ 31'2	- 1'72	- 111'7	33'92	126'7
	5	- 13'87	- 1'2	+ 2'83	- 105'5	- 31'97	- 130'1
	6	- 14'15	- 33'4	+ 7'18	- 92'7	29'81	132'6
	7	- 12'32	- 60'7	+ 11'07	- 74'3	- 27'46	- 134'3
	8	- 8'71	- 78'9	+ 14'25	- 51'1	24'95	135'1
	9	- 3'88	- 85'9	+ 16'48	- 24'7	- 22'28	- 135'0
	10	+ 1'48	- 80'9	+ 17'54	+ 3'3	19'48	134'1
	11	+ 6'62	- 64'4	+ 17'28	+ 30'9	- 16'57	- 132'2
	12	+ 10'78	- 38'7	+ 15'59	+ 55'9	13'56	129'5
	13	+ 13'34	- 7'5	+ 12'46	+ 75'6	- 10'48	- 126'1
	14	+ 13'86	+ 24'8	+ 8'08	+ 87'4	7'35	121'9
	15	+ 12'20	+ 53'0	+ 2'81	+ 89'3	- 4'18	- 116'9
	16	+ 8'57	+ 72'6	- 2'78	+ 80'5	- 1'00	111'2
	17	+ 3'55	+ 80'0	- 8'00	+ 61'5	+ 2'18	- 104'8
	18	- 2'06	+ 74'1	- 12'20	+ 35'0	5'33	97'8
	19	- 7'30	+ 55'9	- 14'96	+ 4'4	+ 8'43	- 90'3
	20	- 11'33	+ 28'7	- 16'07	- 26'7	11'46	82'3
	21	- 13'57	- 3'1	- 15'61	- 55'0	+ 14'42	- 73'8
	22	- 13'71	- 34'2	- 13'76	- 78'4	17'28	64'9
	23	- 11'82	- 60'2	- 10'82	- 95'5	+ 20'03	- 55'6
	24	- 8'24	- 77'4	- 7'10	- 105'5	22'65	46'1
	25	- 3'50	- 83'6	- 2'91	- 108'4	+ 25'13	- 36'3
	26	+ 1'71	- 78'1	+ 1'46	- 104'3	27'45	26'4
	27	+ 6'66	- 61'5	+ 5'71	- 93'7	+ 29'60	- 16'4
	28	+ 10'64	- 36'2	+ 9'60	- 77'3	31'58	- 6'3
	29	+ 13'03	- 5'7	+ 12'88	- 56'3	+ 33'37	+ 3'8
	30	+ 13'43	+ 25'5	+ 15'32	- 31'6	34'95	13'8
	31	+ 11'73	+ 52'6	+ 16'66	- 4'9	+ 36'33	+ 23'7
April	1	+ 8'14	+ 71'0	+ 16'80	+ 22'0	37'50	33'4
	2	+ 3'22	+ 77'6	+ 15'57	+ 47'0	+ 38'45	+ 42'8
	3	- 2'22	+ 71'3	+ 12'96	+ 67'7	39'18	51'9
	4	- 7'27	+ 53'3	+ 9'06	+ 81'5	+ 39'68	+ 60'7
	5	- 11'12	+ 26'6	+ 4'19	+ 86'2	39'95	69'1
	6	- 13'21	- 4'2	- 1'15	+ 80'7	+ 39'99	+ 77'1
	7	- 13'28	- 34'2	- 6'33	+ 65'1	39'81	84'5
	8	- 11'39	- 59'1	- 10'70	+ 41'5	+ 39'40	+ 91'5
	9	- 7'87	- 75'4	- 13'79	+ 13'0	38'77	97'9

Sup. 1886.

the Satellites of Saturn, 1886-87.

503

Greenwich Noon. 1887.		$\alpha_6 - A.$ $\delta_6 - D.$	$\alpha_7 - A.$ $\delta_7 - D.$	$\alpha_8 - A.$ $\delta_8 - D.$
		$\alpha_6 - A.$ $\delta_6 - D.$	$\alpha_7 - A.$ $\delta_7 - D.$	$\alpha_8 - A.$ $\delta_8 - D.$
April	10	- 3'25 - 81''0	- 15'34 - 16''8	+ 37'92 + 103'6
	11	+ 1'81 - 75'2	- 15'35 - 44'9	36'85 108'7
	12	+ 6'59 - 58'9	- 13'97 - 68'9	+ 35'57 + 113'2
	13	+ 10'40 - 34'2	- 11'47 - 87'1	34'10 117'0
	14	+ 12'68 - 4'6	- 8'13 - 98'9	+ 32'43 + 120'1
	15	+ 13'02 + 25'5	- 4'24 - 103'8	30'58 122'5
	16	+ 11'32 + 51'5	- 0'09 - 101'9	+ 28'55 + 124'1
	17	+ 7'80 + 69'0	+ 4'04 - 93'8	26'36 125'0
	18	+ 3'01 + 75'1	+ 7'92 - 80'0	+ 24'03 + 125'1
	19	- 2'26 + 68'6	+ 11'29 - 61'2	21'57 124'5
	20	- 7'14 + 50'9	+ 13'93 - 38'6	+ 18'98 + 123'1
	21	- 10'85 + 25'1	+ 15'62 - 13'5	16'29 121'0
	22	- 12'85 - 4'7	+ 16'18 + 12'4	+ 13'51 + 118'1
	23	- 12'89 - 33'6	+ 15'46 + 37'2	10'66 114'6
	24	- 11'04 - 57'5	+ 13'39 + 58'6	+ 7'75 + 110'4
	25	- 7'61 - 73'0	+ 10'04 + 74'2	4'80 105'5
	26	- 3'12 - 78'2	+ 5'62 + 81'7	+ 1'84 + 100'0
	27	+ 1'78 - 72'4	+ 0'57 + 79'7	- 1'12 93'9
	28	+ 6'42 - 56'5	- 4'53 + 67'8	- 4'07 + 87'3
	29	+ 10'12 - 32'6	- 9'05 + 47'5	6'98 80'1
	30	+ 12'32 - 4'0	- 12'47 + 21'6	- 9'83 + 72'5
May	1	+ 12'65 + 25'0	- 14'48 - 6'7	12'61 64'5
	2	+ 10'99 + 50'0	- 15'01 - 34'2	- 15'31 + 56'2
	3	+ 7'56 + 66'7	- 14'16 - 58'5	17'89 47'5
	4	+ 2'91 + 72'4	- 12'14 - 77'8	- 20'35 + 38'6
	5	- 2'21 + 66'1	- 9'22 - 91'2	22'67 29'5
	6	- 6'95 + 48'9	- 5'67 - 98'3	- 24'83 + 20'3
	7	- 10'56 + 23'9	- 1'76 - 98'9	26'82 11'0
	8	- 12'51 - 4'7	+ 2'25 - 93'3	- 28'63 + 1'7
	9	- 12'56 - 32'6		30'25 - 7'6
	10	- 10'77 - 55'5		- 31'67 - 16'7
	11	- 7'45 - 70'5		32'88 25'6
	12	- 3'09 - 75'5		- 33'86 - 34'3
	13	+ 1'68 - 69'9		34'63 42'7
	14	+ 6'20 - 54'5		- 35'17 - 50'8
	15	+ 9'82 - 31'4		35'47 58'5
	16	+ 11'99 - 3'9		- 35'54 - 65'8
	17	+ 12'33 + 24'2		35'39 72'5
	18	+ 10'74 + 48'3		- 35'01 - 78'6

Ephemeris of the Satellite of Neptune, 1886-87. By A. Marth.

Greenwich Noon. 1886.	P'	<i>a</i>	<i>b</i>	<i>u</i> -U	Diff.	U	B
Sept. 30	323°87	16''78	8''07	35°96	612°42	131°25	-28°77
Oct. 10	323°73	16·85	8·09	288°38	·37	131°44	28°70
20	323°54	16·90	8·10	180°75	·33	131°67	28·62
30	323°35	16·94	8·09	73°08	·30	131°93	28·53
Nov. 9	323°12	16·97	8·08	325°38	·28	132°22	28·42
19	322°89	16·97	8·05	217°66	·27	132°51	28·31
29	322°67	16·96	8·01	109°93	·27	132°80	28·19
Dec. 9	322°46	16·93	7·97	2°20	·29	133°08	28°08
19	322°27	16·89	7·92	254°49	·32	133°33	27·97
29	322°10	16·83	7·87	146°81	·36	133°55	27·88
1887 Jan. 8	321°97	16·75	7·81	39°17	612°39	133°72	-27°80
18	321°87	16·67	7·76	291°56	·44	133°84	27·74
28	321°82	16·58	7·71	184°00	·50	133°90	27·71
Feb. 7	321°81	16·49	7·66	76°50	·56	133°91	27·70
17	321°85	16·39	7·62	329°06	·62	133°86	27·70
27	321°93	16·30	7·59	221°68	·68	133°75	27·73
Mar. 9	322°06	16·21	7·56	114°36	·73	133°58	27·79
19	322°23	16·13	7·54	7°09	612°78	133°36	27·87
29	322°43	16·05	7·53	259°88		133°09	-27·97

P' angle of position of the minor axis of the satellite's apparent orbit, in the direction of superior conjunction.

a, *b*, major and minor semi-axes of the apparent orbit.

u-U, longitude of the satellite in its orbit, reckoned from the point which is in superior conjunction with the planet or in opposition to the Earth.

U + 180°, planetocentric longitude of the Earth, reckoned in the satellite's orbit from the ascending node on the celestial equator.

B, planetocentric latitude of the Earth above the plane of the satellite's orbit.

The values of P', *a*, *b* and *u*-U are to be interpolated for the times for which the apparent positions of the satellite are required, the equation of light being already taken into account in the ephemeris, and the position-angles *p* and distances *s* are then found by means of the equations.

$$s \sin (P' - p) = a \sin (u - U)$$

$$s \cos (P' - p) = b \cos (u - U).$$

The satellite moves in the direction of decreasing position-angles, and will be at its greatest elongations and at its nearest

conjunctions with the planet about the following hours, Greenwich mean time:—

<i>Super. Conj.</i> $p = \frac{P'}{b}$		<i>sp. Elong.</i> $P' - 90^\circ$ a		<i>Infer. Conj.</i> $P' - 180^\circ$ b		<i>nf. Conj.</i> $P' + 90^\circ$ a	
$s =$	h	h	h	h	h	h	h
1886.							
Sept. 29	9.9	Sept. 30	21.2	Oct. 2	8.4	Oct. 3	19.7
Oct. 5	7.0	Oct. 6	18.3		8 5.5		9 16.8
	11 4.1		12 15.3		14 2.6		15 13.9
	17 1.2		18 12.4		19 23.7		21 11.0
	22 22.3		24 9.5		25 20.8		27 8.1
	28 19.1		30 6.6		31 17.9	Nov. 2	5.2
Nov. 3	16.5	Nov. 5	3.7	Nov. 6	15.0		8 2.3
	9 13.6		11 0.8		12 12.1		13 23.4
	15 10.7		16 22.0		18 9.2		19 20.5
	21 7.8		22 19.1		24 6.4		25 17.6
	27 4.9		28 16.2		30 3.5	Dec. 1	14.7
Dec. 3	2.0	Dec. 4	13.3	Dec. 6	0.6		7 11.9
	8 23.1		10 10.4		11 21.7		13 9.0
	14 20.2		16 7.5		17 18.8		19 6.1
	20 17.4		22 4.6		23 15.9		25 3.2
	26 14.5		28 1.7		29 13.0		31 0.3
1887.							
Jan. 1	11.6	Jan. 2	22.8	Jan. 4	10.1	Jan. 5	21.4
	7 8.6		8 19.9		10 7.2		11 18.5
	13 5.7		14 17.0		16 4.3		17 15.6
	19 2.8		20 14.1		22 1.4		23 12.6
	24 23.9		26 11.2		27 22.4		29 9.7
	30 21.0	Feb. 1	8.2	Feb. 2	19.5	Feb. 4	6.8
Feb. 5	18.0		7 5.3		8 11.6		10 3.8
	11 15.1		13 2.3		14 13.6		16 0.9
	17 12.1		18 23.4		20 10.6		21 21.9
	23 9.2		24 20.4		26 7.7		27 18.9
Mar. 1	6.2	Mar. 2	17.4	Mar. 4	4.7	Mar. 5	15.9
	7 3.2		8 14.5		10 1.7		11 13.0
	13 0.2		14 11.5		15 22.7		17 10.0
	18 21.2		20 8.5		21 19.7		23 7.0

Since the last ephemeris of the satellite was published, some weighty evidence concerning the position of the plane of its orbit has become available by the publication of Appendix II. of the Washington Observations for 1881, containing Asaph Hall's paper, "Orbit of the Satellite of Neptune." The question of the position of the plane is a perplexing one. When, in 1865,

I had made a determination of the orbit from the Malta observations of 1863-64, it was to me a puzzle what could be the cause that the values of the node and inclination which, ten years before, I had deduced from Lassell's observations of 1852 ($N = 178^{\circ}74$, $I = 126^{\circ}14$ for 1852'9) should differ from those of the later determination ($N = 181^{\circ}49$, $I = 123^{\circ}86$ for 1864'0) considerably more than the agreement of the measurements of each series, as shown by the probable errors, seemed to permit. The circumstance, that in 1863-64 the form of the apparent orbit was that of a narrow ellipse, favoured the determination of the inclination and node, but was disadvantageous for fixing the satellite's orbital longitude, which was, indeed, left practically indeterminate. Hence my investigation could be only a preliminary one, till further observations should allow the question of orbital longitude to be settled, and I abstained the more readily from publishing merely preliminary results, as at that time I was led to expect that before long I should myself have the opportunity of making the observations requisite for a more complete investigation. When Newcomb's paper, "The Uranian and Neptunian Systems," forming Appendix I. of the Washington Observations for 1873, became known to me, I was surprised that his values of the node and inclination ($N = 183^{\circ}03$, $I = 121^{\circ}70$ for 1874'0) differed from those derived from the Malta observations of 1863-64 in the same direction as these differed from the values found from the earlier series. Making ample allowance for any plausible or possible errors of the Malta observations, I satisfied myself that in 1863-64 the satellite could not have moved in the plane deduced from the Washington observations. However, in the ephemerides published in the *Monthly Notices*, I thought it best to adopt Newcomb's determination, leaving the difficulty to be cleared up by the evidence of further observations. The measurements from other observatories have hitherto been too sporadic to be of real help. But Asaph Hall's "Orbit of the Satellite of Neptune" contributes sufficient evidence to justify a public statement in order to call the attention of astronomers to the consideration of a very perplexing question.

If Hall's values of the node and inclination ($N = 184^{\circ}316$, $I = 120^{\circ}052$ for 1883'0) and the values before-mentioned are transferred from the planes parallel to the terrestrial equator, to which they refer, to the plane of the orbit of Neptune ($N_0 = 3^{\circ}568$, $I_0 = 22^{\circ}339$ for 1880'0), the four determinations furnish the following values of the node and inclination of the satellite's orbit in reference to that of the planet, the longitudes of the node being reckoned along the planet's orbit from the point which precedes the ascending node of the orbit on the ecliptic by $130^{\circ}437$, the ecliptical longitude of this node. If reckoned from the ascending node N_0 of the planetary orbit on the equator, the longitudes of the node are $3^{\circ}29$ less. The probable errors of the values amount only to a few tenths of a

degree, and may be left unnoticed at present, as they and their differences do not affect the question at issue.

		Long. of Node on Neptune's Orbit.	Inclination of the two Orbits.	
Malta	1852	176°20	148°33 or 31°67	if the satellite's motion is reckoned as retrograde.
	1864	180°41	146°19 33°81	
Washington	1874	182°59	144°04 35°96	
	1883	184°31	142°38 37°62	

How are the differences of these values to be explained?

Can they be accounted for by any plausible or possible systematic errors in the observations?

Or do they represent real changes in the position of the plane of the orbit, the effect of some disturbing force which must be found out and traced to its source? What plausible cause can produce such changes? That is the question.

In order to proceed with due caution in this investigation, it is obviously desirable that the available evidence should be strengthened. Considering that a number of sufficiently powerful telescopes, firmly mounted, and provided with superior micrometers, are in existence, is it too much to ask that they should be employed during the present apparition of Neptune at every favourable opportunity in measuring the position-angle and the distance of the satellite (or, if both co-ordinates cannot be got, at least the position-angle), so that, from their united evidence, not only the elements of the orbit may be determined for the present time, but also some evidence may be gained for the consideration of the question of systematic errors? Observers must, of course, be on their guard against any preoccupation or bias, and it may be hoped that the publication of the observations will not be needlessly delayed.

The ephemeris has been computed with the same elements as in preceding years, so that the satellite is assumed to move in the plane of Newcomb's elements for 1874. The variations of the ephemeris if the plane of Hall's elements for 1883, or that derived from the Malta observations, is substituted may be recognised from the following data:—

	Washington 1883.				Malta 1864.		
	P'	U	B		P'	U	B
1886, Sept. 30	321°74	132°90	-29°30	326°52	129°20	-27°90	
Nov. 29	320°53	134°43	28°67	325°34	130°77	27°39	
1887, Jan. 28	319°68	135°52	28°15	324°49	131°89	26°95	
Mar. 29	320°29	134°72	-28°44	325°09	131°07	-27°18	

Errata in Mr. Tebbutt's paper, "Observations of Double Stars at Windsor, N. S. Wales," in *Monthly Notices*, vol. xlv:—

Page 51.—Position angle of Lac. 1181, for $227^{\circ}5$ read $327^{\circ}5$.
 „ 52.—For o Argûs read v Argûs.

Erratum in Mr. Backhouse's paper, "The Great Shower of Andromedes, 1885," in *Monthly Notices*, vol. xlv:—

Page 310, last line of Table I., in column "duration of watch," for 78 read 98.

INDEX.

	PAGE
Achromatic telescope, note with respect to the invention of, Mr. Ranyard	460
Adelaide Observatory, observations of eclipses, occultations, and transits of <i>Jupiter's</i> satellites, made with the 8-inch Cooke equatorial...	353
Associate deceased :—Thomas Clausen	182
Astronomy, notes on the progress of, during the year 1885 :—	
Discovery of minor planets	228
The comets of 1885	<i>ib.</i>
Mr. G. W. Hill on the lunar inequalities due to the ellipticity of the earth	231
Prof. Asaph Hall's researches on the orbits of satellites	234
Prof. H. van de Sande Bakhuyzen on the rotation period of <i>Mars</i>	237
The Cape Catalogue for 1850	238
Uranometria nova Oxoniensis	240
Dr. Müller's sidereal photometry	243
Herr Wolff's sidereal photometry	244
Astronomical photography	245
The American Eclipse Expedition to Caroline Island	248
Prof. Langley's researches on solar heat.....	250
Maps of the spectrum	251
Longitude determinations	252
Auditors, report of the	173
Backhouse, T. W., the great shower of Andromedes, 1885	309
Ball, R. S., occultation of <i>Aldebaran</i> , 1886, January 16	124
— micrometric observations of <i>Nova Andromedæ</i> , made at the Observatory, Dunsink	391
Bigg-Wither, A. C., the meteor shower of 1885, November 27.....	121
Buckney, T., on the superiority of zinc and steel pendulums	462
Calliope, observation of, made at Düsseldorf, Dr. Luther.....	488
Capron, J. R., Andromeda meteors.....	81
Comets :	
1877, I., II., III., VI. ; 1880, III. ; 1882, III. ; and 1884, III., ob- served at Dun Echt, Dr. Copeland.....	489
1885, II. (Brooks), observed at Dun Echt.....	59
— observed by Lieut.-Col. Tupman	123
1885, <i>d.</i> (Fabry), observed at Dun Echt	59
— observed at the Royal Observatory, Greenwich 125, 303, 348, 399	
— observed by Mr. Eddie	455
— sextant observations of	457, 498
— observed at Sydney Observatory	495
1885, <i>e</i> (Barnard), observed at Dun Echt.....	59
— observed at the Royal Observatory, Greenwich 125, 303, 348, 399	

Comets (*continued*):—

1885, <i>e</i> (Barnard), observed at Sydney Observatory	497
1886, <i>a</i> (Brooks), observed at the Royal Observatory, Greenwich, 400, ...	459
————— observed at Sydney Observatory	497
1886, <i>c</i> (Brooks), observed at Sydney Observatory	<i>ib.</i>
Biela's, search for, Dr. Gill	124
Common, A. A., the nebulae in the <i>Pleiades</i>	341
Copeland, R., on the meteoric shower of November 27, 1885	66
————— on a new star in the constellation of <i>Orion</i>	109
————— note on Dr. Copeland's paper, Mr. Maunder.....	284
Denning, W. F., the great shower of Andromedes, November 26, 27, 28, and 30, 1885	68
————— changes in the red spot on <i>Jupiter</i>	115
————— note on the radiation of meteors.....	346
————— <i>Jupiter's</i> third satellite in transit, April 11, 1886	394
————— meteor shower of Halley's Comet	396
Denza, F., la grande pluie des étoiles filantes du 27 Novembre, 1885 ...	76
Downing, A. M. W., comparisons of certain southern star catalogues ...	365
Dreyer, J. L. E., on the proper motion of twenty-nine telescopic stars ...	379
Dun Echt Observatory, observations of Comets Brooks, Fabry, and Barnard, made with the filar micrometer of the 15-inch refractor.....	59
————— meteoric shower of November 27, 1885.....	66
————— observations of Comets 1877, I., II., III., VI.; 1880, III.; 1882, III.; and 1884, III., made with the 15-inch refractor ...	489
Eclipse of the Sun, 1885, Sept. 9, observed at Wellington, New Zealand, Mr. Marten	23
Eclipses, total solar, A.D. 878 to 1724, Mr. Maguire.....	25
Eddie, L. A., observations on Fabry's Comet (<i>d</i> 1885).....	455
Espin, Rev. T. E., note on Mr. Chambers's suspected new variable in <i>Corona Borealis</i>	22
————— some new red and orange-red stars	293
Fellows deceased, list of	182
————— elected.....I, 35, 91, 169, 325, 365, ...	403
Finlay, W. H., the magnitude of η <i>Argus</i> in March 1886.....	340
Franks, W. S., introduction to a catalogue of the colours of 1730 stars ...	342
Gill, D., search for Biela's comet.....	124
————— on some suggested improvements in the practical working of M. Loewy's new method of determining the elements of astronomical refraction	325
Glasgow Observatory, observations of the meteor shower of Nov. 27, 1885, Prof. Grant	64
Gledhill, J., phenomena of the satellites of <i>Jupiter</i> and <i>Saturn</i> , and occultations of stars by the Moon, observed at Mr. Edward Crossley's observatory, Bermerside, Halifax, in the year 1885, with the 9 $\frac{1}{2}$ -inch Cooke refractor.....	150
Gore, J. E., on a suspected new variable in <i>Corona Borealis</i>	58
————— on the orbit of γ <i>Coronæ Australis</i>	103
————— on a new variable star of short period.....	106
————— on the new star in <i>Orion</i>	108, 392
————— on the orbit of 40 (O ²) <i>Eridani</i>	291
————— on the orbit of ζ <i>Sagittarii</i>	444
Governor, a new form of, for the driving clocks of equatorials, Mr. Hilger	155
Grant, R., observations of the meteor shower of November 27, 1885, made at the Glasgow Observatory.....	64
Green, N. E., the northern hemisphere of <i>Mars</i>	445

Greenwich, Royal Observatory, observations of the spectrum of the new star in <i>Andromeda</i> (Mr. Maunder)	19
— observations of the Biela comet meteors	60
— observations of the spectrum of <i>Nova Orionis</i> (Mr. Maunder)	114
— observations of Comets <i>d</i> 1885 (Fabry) and <i>e</i> 1885 (Barnard)	125, 393, 348, 399
— spectroscopic results for the motions of stars in the line of sight, obtained in the year 1885, No. IX.	126
— observations of occultations of stars and <i>Uranus</i> by the Moon, and of phenomena of <i>Jupiter's</i> satellites, made in the year 1885	136
— observations for coincidence of the collimators through the cube of the transit circle (Mr. Turner)	329
— observations of Comet <i>a</i> 1886 (Brooks)	400, 459
Hall, A., observations made at the U.S. Naval Observatory, Washington	453
Henry, on photographs of a new nebula in the <i>Pleiades</i> and of <i>Saturn</i>	98
— the photographic nebulae in the <i>Pleiades</i>	281
Hilger, A., a new form of governor for the driving clocks of equatorials	155
Hopkins, B. J., erratic meteors	27
— note on a remarkable sun-spot	393
Hough, G. W., observations of the companion of <i>Sirius</i> made at the Dearborn Observatory, Chicago	393
Howlett, F., notes on the meteorites of November 27, 1885, as seen at East Tisted Rectory, Alton, Hants.....	83
— on the asserted foreshortening of the inner side of the penumbra of spots when near the Sun's limb	447
Johnson, S. J., occultation of <i>Uranus</i> , 1885, Dec. I.....	58
<i>Jupiter</i> , changes in the red spot on, Mr. Denning.....	115
— satellites of, observed at the Royal Observatory, Greenwich ...	139
— — — — — Mr. Crossley's Observatory, Bernerside, Halifax	150
— — — — — Stonyhurst, Mr. Perry.....	315
— — — — — the Radcliffe Observatory, Oxford.....	352
— — — — — Adelaide Observatory	353
— — — — — third satellite of, in transit, April 11, 1886, Mr. Denning	394
— — — — — fourth satellite of, during superior conjunction, April 5, 1886, Dr. Spitta.....	451
<i>Jupiter</i> and <i>Saturn</i> , drawings of.....	364
Loewy, M., suggested improvements in the practical working of his new method of determining the elements of astronomical refraction, Dr. Gill	325
Lohse, J. G., observations of the new star in <i>Andromeda</i> , made at Mr. Wigglesworth's Observatory with the 15·5-inch Cooke refractor	299
Lunar theory:—	
On the term of long period due to <i>Mars</i> in the expression for the longitude of the Moon, Mr. Neison	35
On Delaunay's method for calculating terms of long period in the motion of the Moon, Mr. Neison	404
Luther, R., observation of <i>Calliope</i> , made at the Observatory, Düsseldorf	488
Mackenzie, T., on the application of a Nicol's prism to sextant observations	29
Maguire, J., total solar eclipses, A.D. 878 to 1724.....	25
<i>Mars</i> , ephemeris for physical observations of, Mr. Marth	29, 86
— and its satellites, note on the transit of, across the Sun's disc, which will occur for the planet <i>Jupiter</i> , April 13, 1886, Mr. Marth.....	161
— — — — — ephemeris of the satellites of, 1886, Mr. Marth.....	164
— — — — — the northern hemisphere of, Mr. Green	445
— — — — — satellites of, observed at the U.S. Naval Observatory, Prof. Hall	454

Marten, C. R., notes on the total solar eclipse of September 9, 1885, viewed at the Terrace, Wellington, New Zealand.....	23
Marth, A., ephemeris for physical observations of <i>Mars</i> , 1886	29, 86
———— ephemeris of the satellites of <i>Uranus</i> , 1886	88
———— note on the transit of the planet <i>Mars</i> and its satellites across the Sun's disc, which will occur for the planet <i>Jupiter</i> and its satellites on April 13, 1886	161
———— ephemeris of the satellites of <i>Mars</i> , 1886	164
———— ephemerides of the satellites of <i>Saturn</i> , 1886–87	469, 499
———— ephemeris of the satellite of <i>Neptune</i> , 1886–87	504
———— note on his “intersects,” Mr. Turner	157
Maunder, E. W., observations of the spectrum of the new star in the great nebula in <i>Andromeda</i> , made at the Royal Observatory, Greenwich	19
———— observations of the spectrum of <i>Nova Orionis</i> , made at the Royal Observatory, Greenwich.....	114
———— note on some recently published spectroscopic obser- vations	282
———— note on M. Trouvelot's paper on the protuberances visible on the spectrum with a narrow slit	334
Meteors, Biela:—	
Observations made at the Royal Observatory, Greenwich	60
Observations made at the Glasgow Observatory, Prof. Grant.....	64
Observations made at the Oxford University Observatory, Prof. Pritchard	65
On the meteoric shower of 1885, Nov. 27, R. Copeland	66
The great shower of Andromedes, Nov. 26, 27, 28 and 30, 1885, Mr. Denning	68
La grande pluie des étoiles filantes du 27 Nov., 1885, Padre Denza	76
Observations and orbit of the meteor shower of 1885, Nov. 27, Col. Tupman	79
Andromeda meteors, Mr. Capron	81
Meteor shower connected with Biela's comet, Mr. Perry	83
Meteorites of 1885, Nov. 27, as seen at East Tisted Rectory, Alton, Hants, Mr. Howlett.....	83
Meteoric display, 1885, Nov. 27, Col. Ward	84
Meteoric shower as seen at Clapham, 1885, Nov. 27, Dr. Spitta.....	85
Note on the Biela meteors, Mr. Proctor.....	118
Observations made at the Radcliffe Observatory, Oxford, Mr. Robinson	119
Display of meteors, 1885, Nov. 27, Mr. Wickham	120
Meteor shower of 1885, Nov. 27, Major Bigg-Wither	121
Meteor shower of 1885, Nov. 27, Major Strahan	ib.
Meteor shower of 1885, Capt. Wilson-Barker	122
The great shower of Andromedes, 1885, Mr. Backhouse	309
Meteor shower of Halley's comet, Mr. Denning	396
Meteors, erratic, Mr. Hopkins	27
———— radiation of, Mr. Denning	346
Mouchez, E., proposal for photographing the heavens	I
Nebulæ in the <i>Pleiades</i> , MM. Henry	98, 281
———— Mr. Common	341
Neison, E., on the term of long period due to <i>Mars</i> in the expression for the longitude of the Moon	35
———— on Delaunay's method for calculating terms of long period in the motion of the Moon	404
<i>Neptune</i> , ephemeris of the satellite of, 1886–87, Mr. Marth	504
Nicol's prism, on the application of, to sextant observations, Captain Mackenzie	29
Noble, W., daylight occultation of <i>Aldebaran</i> on July 9, 1885, observed at Forest Lodge, Maresfield.....	27

Nova Andromedæ :—

Photometric observations of, Prof. Pritchard	18
Observations of the spectrum of, Mr. Maunder.....	19
The outburst in <i>Andromeda</i> , Mr. Perry	22
Observations of the magnitude of, at the Radcliffe Observatory, Oxford	56
Observations of, at Mr. Wigglesworth's Observatory, Mr. Lohse ...	299
Micrometric observations of, Sir R. S. Ball	391

Nova Orionis :—

On the new star in <i>Orion</i> , Mr. Gore	108, 392
On a new star in the constellation of <i>Orion</i> , Dr. Copeland	109
Note on Dr. Copeland's paper, Mr. Maunder.....	284
Observations of the spectrum of <i>Nova Orionis</i> , Mr. Maunder	114
The new star in <i>Orion</i> , photometrically and spectroscopically ob- served, Prof. Pritchard	298

Obituary : List of Fellows and Associate deceased

Bayfield, H. W.....	<i>ib.</i>
Evans, F. J. O.	183
Hannington, J. C.	187
Hartnup, John	188
Ladd, William	191
Lawson, James	192
McDowell, James	<i>ib.</i>
Martindale, Nicholas	193
Ratcliff, Charles	<i>ib.</i>
Shaftesbury, Earl of.....	194
Sidebotham, Joseph	<i>ib.</i>
Southwood, Thomas A.....	196
Watson, John	197
Webb, T. W.	198
Wray, William	201
Yolland, William	202

Observatories, accounts of proceedings of, during 1885 :—

Greenwich, Royal	204
————— erratum	323
Armagh	208
Cambridge	209
Dunsink	210
Edinburgh, Royal	211
Glasgow.....	212
Kew	<i>ib.</i>
Liverpool	214
Oxford, Radcliffe	<i>ib.</i>
Oxford, University	215
Rugby	216
Stonyhurst	<i>ib.</i>
Mr. Barclay's, Leyton, Essex	217
Mr. Common's, Ealing	<i>ib.</i>
Earl of Crawford's, Dun Echt.....	218
Mr. Crossley's, Bermerside, Halifax	219
Earl of Rosse's, Birr Castle	<i>ib.</i>
Lieut.-Colonel Tupman's, Harrow	<i>ib.</i>
Cape of Good Hope, Royal	221
Hong Kong	227

Oxford, Radcliffe Observatory, observations of the magnitude of *Nova*

Andromedæ

————— observations of the Moon during the year 1885.....	91
————— observations of the meteors of 1885, Nov. 27, Mr. Robinson ...	119
————— observations of occultations by the Moon, 1884-85, and of eclipses of the IVth satellite of <i>Jupiter</i> , 1885	350

	PAGE
Oxford, University Observatory, photometric observations of the Nova in the <i>Andromeda</i> nebula	18
——— the Biela meteor shower of November 27, 1885	65
——— the new star in <i>Orion</i> photometrically and spectroscopically observed	298
Pendulums, zinc and steel, on the superiority of, Mr. Buckney	462
Perry, S. J., the outburst in <i>Andromeda</i>	22
——— meteor shower connected with Biela's comet	83
——— occultations of stars by the Moon, and phenomena of <i>Jupiter's</i> satellites, observed at Stonyhurst Observatory	314
Photographic film, remarkable instance of the detection of distortion in a, Prof. Pritchard	442
——— maps of the stars, Mr. Roberts	99
Photographing the heavens, proposal for, Admiral Mouchez	1
Photographs of a new nebula in the <i>Pleiades</i> , and of <i>Saturn</i> , MM. Henry	98
Photography, celestial: on the connection between photographic action, the brightness of the luminous object, and the time of exposure, Mr. Ranyard	305
Photometer, wedge: on Dr. Wilsing's experimental examination of, and on the degree of accuracy attainable by means of that instrument, Prof. Pritchard	2
Powell, E. B., additional remarks on the periodic time of <i>a Centauri</i>	289
——— on the orbit of <i>a Centauri</i>	336
Precessions, Bessel's, reduction of, to those of Struve, Mr. Rambaut	43
Pritchard, C., on Dr. Wilsing's experimental examination of the wedge photometer; and (II) on the degree of accuracy attainable by means of that instrument	2
——— photometric observations of the Nova in the <i>Andromeda</i> nebula, made at the Oxford University Observatory	18
——— the Biela meteor shower of November 27, 1885	65
——— the new star in <i>Orion</i> , photometrically and spectroscopically observed at the Oxford University Observatory	298
——— supplementary measures of the magnitudes of a zone of star near the equator for reference as standards of magnitude in lieu of <i>Polaris</i>	439
——— on a remarkable instance of the detection of distortion in a photographic film measured for the purpose of stellar parallax	442
Proctor, R. A., note on the Biela meteors	118
Protuberances visible on the spectrum with a narrow slit, M. Trouvelot	331
——— note by Mr. Maunder	334
Rambaut, A. A., on the reduction of Bessel's precessions to those of Struve	43
Ranyard, A. C., on the connection between photographic action, the brightness of the luminous object, and the time of exposure, as applied to celestial photography	305
——— note with respect to the invention of the achromatic telescope	460
Report of the Council to the sixty-sixth annual general meeting of the Society	169
——— List of papers read, from February 1885 to February 1886	255
——— List of donors to library, &c.	260
——— President's address on presenting the gold medal to Professors Pickering and Pritchard	265
——— List of officers and council	279
Roberts, L., photographic maps of the stars	99
Robinson, W. H., observations of the meteors of 1885, November 27, made at the Radcliffe Observatory, Oxford	119

Safford, T. H., comparison of Groombridge's and Struve's right ascensions of close circumpolar stars.....	37
<i>Saturn</i> , conjunction of, and μ <i>Geminorum</i> , Jan. 10, 1886, Mr. Tebbutt ...	304
— drawings of.....	364
— on photographs of, M.M. Henry	98
<i>Saturn</i> , satellites of, observed at Mr. Crossley's Observatory, Bermerside, Halifax	153
— conjunctions observed at the U.S. Naval Observatory, Prof. Hall.....	453
— ephemerides, 1886-87, Mr. Marth	469, 499
Sextant observations, application of a Nicol's prism to, Capt. Mackenzie ..	29
Sherman, O. T., note on his spectroscopic observations, Mr. Maunder ...	282
Spitta, E. J., the meteoric shower, as seen at Clapham on the night of November 27, 1885	85
— the fourth satellite of <i>Jupiter</i> during superior conjunction on the night of April 5, 1886	451
Stars, circumpolar, comparison of Groombridge's and Struve's right ascensions of, Prof. Safford	37
— motions of, in the line of sight; spectroscopic results obtained at the Royal Observatory, Greenwich, in the year 1885, No. IX.	126
— some new red and orange-red, Mr. Espin	293
— colours of, introduction to a catalogue of the, Mr. Franks	342
— telescopic, proper motion of, Dr. Dreyer.....	379
— near the equator as standards of magnitude, supplementary measures of, Prof. Pritchard	439
Stars, double; observations of, at Windsor, New South Wales, Mr. Tebbutt	50
— on the orbit of γ <i>Coronæ Australis</i> , Mr. Gore.....	103
— additional remarks on the periodic time of α <i>Centauri</i> , Mr. Powell	289
— on the orbit of α <i>Centauri</i> , Mr. Powell	336
— on the orbit of 40 (α^2) <i>Eridani</i> , Mr. Gore	291
— observations of the companion of <i>Sirius</i> , Prof. Hough	393
— companion of <i>Sirius</i> , observed at the U.S. Naval Observatory, Prof. Hall	454
— on the orbit of ζ <i>Sagittarii</i> , Mr. Gore.....	444
Stars, occultations of, by the Moon :—	
— observed at the Royal Observatory, Greenwich, 1885	136
— Mr. Crossley's Observatory, Bermerside, Halifax	155
— Stonyhurst, Mr. Perry	314
— Beloit, Wisconsin, 1884-85, Mr. Tatlock	318
— the Radcliffe Observatory, Oxford.....	350
Daylight occultation of <i>Aldebaran</i> , 1885, July 9, observed by Capt. Noble	27
Occultation of <i>Aldebaran</i> , 1886, Jan. 16, Prof. Ball.....	124
Stars, variable :—	
— Note on Mr. Chambers's suspected new variable in <i>Corona Borealis</i> , Mr. Espin	22
— On the suspected new variable in <i>Corona Borealis</i> , Mr. Gore	58
— On a new variable star of short period, Mr. Gore.....	106
— The magnitude of η <i>Argus</i> in March 1886, Mr. Finlay.....	340
— Observations of <i>R Carinæ</i> , Sept. 1883 to April 1886, Mr. Tebbutt... ..	487
— See <i>Nova Andromedæ</i> , <i>Nova Orionis</i> .	
Star catalogues, southern, comparisons of, Mr. Downing	365
Stone, E. J., observations of the Moon made at the Radcliffe Observatory, Oxford, during the year 1885, and a comparison of the results with the tabular places from Hansen's Lunar tables	91
Strahan, G., the meteor shower of 1885, November 27.....	121
Sun-spot, note on a remarkable, Mr. Hopkins	393

	PAGE
Sun-spots, asserted foreshortening of the penumbra of, Mr. Howlett.....	447
Sydney Observatory, observations of Comets <i>d</i> 1885 (Fabry), <i>e</i> 1885 (Barnard), <i>c</i> 1886, and <i>I</i> . 1886 (Brooks)	495
Tatlock, J., occultations observed at Beloit, Wisconsin, in 1884-85	318
Tebbutt, J., observations of double stars at Windsor, New South Wales	50
observation of the conjunction of <i>Saturn</i> and μ <i>Geminorum</i> ,	
January 10, 1886	304
observations of the variable star <i>R Carinae</i> from Sept. 1883 to April 1886.....	487
Thackeray, W. G., on the semi-diameter of <i>Venus</i>	335
Trouvelot, E. L., note on his spectroscopic observations of solar prominences, Mr. Maunder	287
on the protuberances visible on the spectrum with a narrow slit.....	331
note on M. Trouvelot's paper, Mr. Maunder	334
Tupman, G. L., observations and orbit of the meteor shower of 1885, November 27.....	79
observations of the Comet 1885 (Brooks), at Harrow, with the 18½-inch equatorial reflector.....	123
Turner, H. H., note on Mr. Marth's 'intersects'	157
note on the observations for coincidence of the collimators through the cube of the transit circle at the Royal Observatory, Greenwich	329
<i>Uranus</i> , ephemeris of the satellites of, 1886, Mr. Marth	88
occultation of, Mr. Johnson	58
observed at the Royal Observatory, Greenwich...	138
<i>Venus</i> , semi-diameter of, Mr. Thackeray	335
Ward, M. F., meteoric display, November 27, 1885	84
Wickham, W., display of meteors, 1885, November 27.....	120
Wilsing's experimental examination of the wedge photometer, Prof. Pritchard ..	2
Wilson-Barker, D., the meteor shower of 1885	122

LIST OF PRESENTS

RECEIVED DURING THE SESSION OF 1885-86,

AND OF

BOOKS PURCHASED WITH THE TURNOR AND
HORROX FUNDS

DURING THE SAME PERIOD,

FORMING

APPENDIX II.

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